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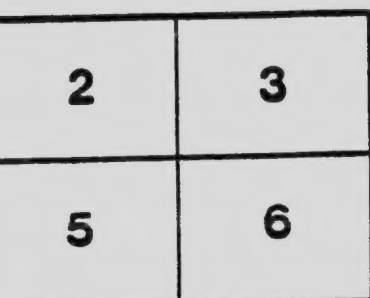
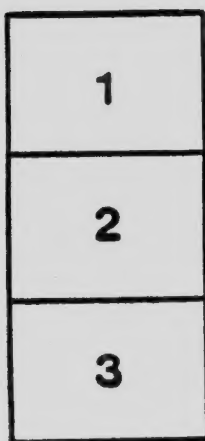
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BULLETIN No. 3

## HOW TO HANDLE FROZEN FISH

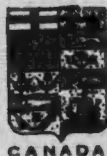
BULLETIN No. 4

## HINTS ON FROZEN FISH

BY

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## How to Handle Frozen Fish.

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Frozen fish are certain to be one of the great food commodities of the future. There has long existed a prejudice in the mind of the public against frozen fish, but this prejudice has no just basis, and fish as well as other cold storage commodities are becoming recognized as practically as good for the table as are fresh fish. In countries like England frozen fish were almost unknown until very recently. Since the war began there has been a vast change, and in the great fish markets of Britain frozen fish are now figuring, and will figure on an enormous scale in future years, while in Canada, the United States and other countries, the demand for frozen fish, which has been very great in the past, will be enormously increased.

How can frozen fish be supplied to the public in the best possible condition? There is no doubt that frozen fish have often been badly handled by fishermen and fish merchants, by express and freight employees, and even by retail dealers who have done many things which injured the frozen fish and spoiled the product. In the home the cook has usually not known how to handle frozen fish, and frequently spoiled it before it reached the table. All this can be put right, and everything which spoils frozen fish must be avoided in the future, for it has been proved that refrigeration preserves all the best qualities present in fresh fish, and affords many advantages in preservation and in shipping which are not possessed by fresh fish. Frozen fish are superior to salted or cured or smoked fish, excellent as these are for food. Two eminent scientists recently stated that they could not tell which were fresh and which were frozen fish, when both were cooked and placed on the table at the same time as a test. In taste and texture of the flesh they were declared hardly distinguishable from each other.

What are the essential conditions which the fisherman should observe and which the shipper and the retailer should bear in mind when handling frozen fish?

(1) Handle fish as carefully as possible. If bruised, gashed or trampled on, their best selling and food qualities are destroyed.

(2) Avoid piling the fish in such masses that they crush each other out of shape. Appearance and flavour are lost by heavy pressure.

(3) Fish should be cleaned, washed to remove the blood, and packed in cracked or crushed ice, so as to keep them in the best condition. Gutted fish packed immediately in crushed ice keep better than ungutted fish.

(4) On bringing the fish ashore, they should be placed in cold conditions, crushed ice being used; or transferred in quantities to large central freezers, where rail shipments can be made up. Fish change and lose quality immediately after death, and they are best if placed at once in cold conditions. In 36 to 48 hours, unless placed in cold storage, decomposition is apparent especially in the region of the intestines.

(5) The cold conditions should be kept uniform, for if the temperature rises or the fish are allowed to thaw, they spoil more quickly than if never frozen at all. Heat and rise in temperature are much to be feared.

Three very important points must never be forgotten by the fishermen and by others handling frozen fish. First: freezing does not make a fresh fish out of a bad fish. Fish must be fresh and in the best condition on being subjected to refrigeration, and all their food qualities must be preserved without any serious change. Second: fish should not be thawed out and refrozen, as deterioration and loss of quality results. Once frozen they must be kept at the same low temperature until used for food. Third: Rapidity of decay after removal from ice is in proportion to the number of hours elapsing before icing the freshly-caught fish.

The methods of freezing fish may be classified as, first, the dry method, that is freezing in the cold air or in a refrigerator, second, the wet method, which is freezing in brine at a very low temperature.

Fish when frozen by the first method are best if the blood and mucus are removed, usually gutted, and placed in crushed ice, and carried from the boat to the quick freezer, and placed in trays or on racks close to the refrigeration pipes at a temperature much below freezing.\* In twelve to fourteen hours the fish are usually frozen solid.

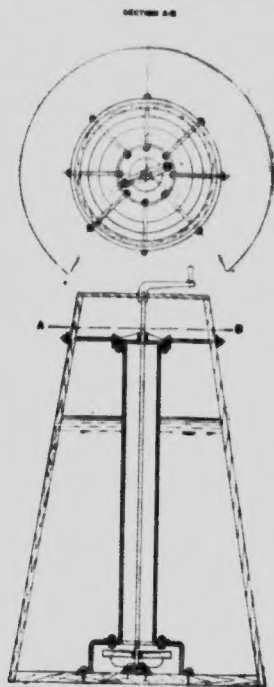
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\*The "sharp freezer" is often 5° to 18° below zero F.

The fish may be removed and kept in cold storage for many months at a temperature of  $7^{\circ}$  to  $10^{\circ}$  F., that is  $25^{\circ}$  to  $22^{\circ}$  below freezing.

"Too often," as an eminent United States expert on fish refrigeration reported, "freezing fish has meant saving those which were already deteriorating." Freezing cannot improve fish, but summer-caught are usually better frozen, unless marketed immediately in a chilled condition, and, if frozen, then deterioration due to heat is prevented.

The second method, namely, freezing in brine, is very effective. A brine freezer may be of small capacity and carried on the fishing-boat, as has been done in Norway, or a freezer of large capacity at some central point convenient for receiving the catches.



The small brine freezer consists of a wooden tub (see figure of the apparatus in longitudinal and in cross sections) capable of holding about forty cod of average size. In the centre is fixed a cylindrical vessel of iron, open at the top and covered with wire netting at the bottom, and in the centre a screw propeller is placed near the bottom of the tub and provided with a handle at the upper end of a perpendicular axle. The tub is filled two-thirds with a strong brine solution, and crushed ice is placed in the iron cylinder and in the tub. The axle is made to revolve and the brine drawn down into the ice-filled cylinder, and the water circulating become intensely cold in a short time (15 minutes). It is necessary to put more ice into the cylinder as it melts, to keep the temperature down. The fish are suspended in the space around the cylinder, when the temperature reaches  $32^{\circ}$  F., and should not be placed too closely so that they do not freeze massed together.† To keep the temperature even, salt and ice must be placed in the inner vessel, as the temperature

rises, and the propeller must be worked continuously, if many fish are in the tub. If the tub is only partially filled with fish, it can be stopped for a while.

†Galvanized wire baskets are convenient and effective for holding the fish.

A similar form of small brine-freezer can be used where ammonia-freezing gear is available, and a coil of pipes carried into the tub to reduce the temperature instead of the cruder iron cylinder with crushed ice and salt just described.

Brine freezers of large capacity can be established in the form of iron-lined tanks with a coil of pipes connected with an expansion ammonia refrigeration machine.

It has been found that whereas marketable fish, such as salmon, cod, etc., are thoroughly frozen by the usual cold-air refrigeration in thirty-six hours to forty-eight hours, such fish are frozen perfectly by the brine method in about one and one-half hours, and halibut and large cod in about three hours. The time occupied for proper freezing varies with the size and shape of fish, the kind of fish, the thickness of fish, etc. About a ton of fish per day can be frozen in a brine refrigeration tank, costing about \$100, and the cost of salt and ice would not be more than \$2 or \$3.

Tests which have been made with the brine method have proved that:—

- (1) Freezing is accomplished with great rapidity, one-fifteenth or one-twentieth the time occupied by older methods.
- (2) The best edible qualities are retained.
- (3) There is practically no shrinkage, thus retaining the attractive appearance of fresh fish.
- (4) The natural colour of the fish remains.
- (5) The fish is frozen solid as if penetrated by glare ice.
- (6) The flesh (muscles) and organs are not disturbed and the curd and solid matters are retained.
- (7) If the fish are wrapped in non-conducting paper (preferably parchment paper) there is no deterioration for seven or eight days, when removed from cold storage; but for shipping purposes, powdered cork is an effective packing between the wrapped fish.

With proper care and an observance of the conditions mentioned above, frozen fish will reach the consumer in the best possible condition. If the markets can be supplied with frozen fish in an attractive condition, the demand will not only immediately increase and the prejudice against frozen fish be removed, but there is no doubt that it will tend to largely do away with the demand for unfrozen fresh fish in localities distant from the fishing grounds, which demand it is often difficult to supply.



## HINTS ON FROZEN FISH.

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I. *Cold Preserves Food Products.*—That cold prevents putrefaction and prevents fresh fish and other perishable products from decay, is recognized by everybody. The careful housewife always keeps her milk, butter, poultry, etc., in a cool place, or in a kitchen refrigerator. Efficient cold-storage permits articles of food to be kept for long periods, and within certain limits, there is no essential change or deterioration.

II. *Nature's Wonderful Refrigeration.*—The most extraordinary instance of preservation by cold storage is that discovered in eastern Siberia, 15 or 16 years ago, by Dr. O. F. Herz of Petrograd, namely, a huge frozen mammoth elephant. This monstrous hairy elephant, or mammoth, has been extinct for many thousands of years, but a specimen was found at the bottom of a hill on the Berosofka river, and had evidently been killed by falling over a cliff. It became imbedded in ice, where it had remained for over 2,000 years. Dr. Herz and his staff excavated the monster out of its bed of ice. They found it in a lying posture, with its feet bent beneath it, and its neck broken. There was grass, in its mouth and stomach, undigested, and the flesh had been preserved in such a fresh state that a portion of the animal's trunk and a small piece of the back, exposed during summer thaws, had been eaten by wolves. The skin covered with thick brown hair, and the huge body, were excellently preserved. It was a case of refrigeration on a wonderful scale by "Mother Nature". Similar cases of fresh portions of mammoth preserved in ice sheets were discovered in the Klondike region of Canada by gold-miners. If Nature preserves such huge animals in a fresh condition for twenty centuries, it is surely not difficult for modern ingenuity to devise schemes for perfect preservation in cold storage.

III. *Advantages in Freezing Fish.*—Food preservation has now become so perfected that the world's markets in the future will depend

more and more on meats, fruits, etc., kept in cold storage. The cold storage of fish has accomplished four advantages:—

(1) It secures in months of scarcity a good supply of fish, captured and frozen in the months of excessive abundance. Cold storage of fish prevents a "glut" in the market, which always involves loss of valuable food for the people.

(2) It enables large shipments to be made to inland cities and populous areas located away from the waters where the fish are captured in plenty, and cheaply. The east can enjoy western fish, and the west can enjoy eastern fish, while the great interior lakes can supply both, and thus there can be interchange of fish products all over the country.

(3) It ensures fish of good quality, having all the excellencies of the fresh product for the table. Fish deteriorate, lose flavour, appearance and weight, the longer they are kept after capture, but if frozen, they will retain their good qualities for many months under proper conditions.

(4) It enables the wholesale and retail fish merchants to supply the public at lower average prices than would be otherwise possible; the chief supplies of fish being frozen in times of abundance and cheapness.

*IV. Conditions for Successful Freezing.*—If efficient freezing methods are adopted, neither flavour nor appearance are lost, and the best frozen fish result, if the three following conditions are observed:—

(1) The fish must be frozen in fresh, prime condition, as soon as possible after capture. If decay has begun, freezing will not make them fresh fish.

(2) The fish must not be exposed to the sun or to heat, or be knocked about and bruised. They should be handled as little as possible, and with care.

(3) Fish once frozen must not be allowed to thaw, or subjected to a rise in temperature, as that spoils and changes their quality.

*V. Speed and Care Necessary Before Freezing.*—Fish freezers are best located as near the fishing grounds as possible, and the fish should be frozen within three or four hours after capture, otherwise the fisher-



men should use broken ice plentifully, cover them over from the sun's heat by canvas sails, and keep them as cold as possible, and unexposed, until they reach the freezers.

*VI. Four Stages in Fish Freezing.*—(1) All blood, dirt and slime on the outside of the fish should be washed off, and they should be gutted, if large fish; but smaller fish may be frozen in "the round." Indeed, some markets desire fish not gutted and in "the round."

(2) The fish after washing are placed on metal sheets, or thin boards, or on trays, and brought into direct contact with the refrigeration pipes in the "Sharp Freezer." Air circulates in this chamber at a temperature of 5° or 18° below zero F. (-20° to -27° C.), the pipes forming a successive series of shelves one above the other. After 12 to 30 hours, the fish can be removed. A little cold water poured on the outside will detach them.

(3) They are now taken to the glazing room, where there is a temperature of 20° to 25° F. (-6.6° to -3.8° C.) and the single fish, or blocks of fish, are submerged in clean cold water just about 32° F. so that they become enclosed in a coat of ice like glistening varnish. This glaze preserves the aroma and flavour of the fish, which are otherwise lost, probably owing to oxidation of the fatty elements in the fish. Glazing is repeated usually three or four times until the coat of ice is thick enough to prevent any deterioration.

(4) The glazed fish are placed on the floor, or in boxes with paper lining, or on the shelves of the cold storage rooms, where the temperature ranges from 0° to 10° F. (-17.7° to -12.2° C.). Some prefer a lower temperature, say 5° below zero F. Boxed fish, with paper lining, keep 3, 4 and 5 months without loss of quality. Large fish require to be wrapped in a separate sheet of paper, vegetable parchment being the best. The temperature should be tested by holding the thermometer near the ceiling of the cold storage chamber, as warm air rises. All doors must be kept closed as much as possible, so that warm air is not admitted from the outside.

*VII. Re-glazing.*—As ice evaporates even at freezing temperature, the glaze becomes thinner, and, in three to five months, fish in cold storage require to be re-glazed by pouring upon them a spray of clean water, which forms a thin coating of ice.

VIII. *Other Refrigeration Methods.*—There are many other methods of refrigeration, namely, Ottesen's Brine Method, Henderson's Wet Method, the Kapaida Sterilized Gas Method, but these have not been very widely adopted, and are dealt with in another Bulletin of this series.

IX. *Marketing Frozen Fish.*—Frozen fish should be sold within a few months after freezing; indeed, before the fresh fish supply comes again into the market. Six to eight months, at the outside, is a good time limit, but if held for twelve months there is little important change in food value. Efficient freezing retains the fish in practically the same condition as when first frozen.

X. *Frozen Fish Retain Best Elements.*—Accurate investigations by experts prove that there is no important difference between frozen fish and fresh fish of the same species, and no loss of nitrogenous elements, which give fish their chief value as food. A distinguished expert on food refrigeration (Professor ARMAND GAUTHIER) declares "that food preserved by refrigeration is in every way as nutritious as when fresh". He refers to beef and mutton generally, but his observation applies to fish and other foods.

XI. *Handling Fish After Cold-Storage.*—Fish should reach the consumer after being taken from cold storage with all speed, and, if possible, before the ice-glaze has altered or disappeared. The consumer after receiving a package of frozen fish from the retail store should defrost it and cook it as soon as possible, placing the frozen fish in a covered vessel or in a cold outhouse, or kitchen refrigerator. It will thaw out and retain its food and table qualities. It need not be soaked in water, cold or warm, for some excellent qualities are always lost when fish are soaked in water. It is not necessary to defrost frozen fish in cold water; but if this be done, remove it from the water as soon as all the frost is out, and never use warm water, hot water or other heat or it will lose its firmness and excellence of flavour.

